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AËRONAUTICAL CHARTS

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The Sperry Gyroscope Company

In November, 1915, the well-known aviator, the late Victor Carlstrom, made a memorable flight from Toronto, Canada, to New York, flying without mishap until his arrival at the latter place, where darkness and a low-lying haze rendered it impossible for him to distinguish Governors Island, his intended destination. Believing it a waste of valuable time to make a further search for Governors Island, Carlstrom headed his machine for New Jersey, where he felt certain that territory suitable for a landing place could be found. He had not traveled far from New York when he sighted a stretch of country that seemed perfectly suited to his needs. When it was too late, however, to prevent a landing, he discovered that the stretch of country was marsh land of the "Jersey Meadows," and it was only by his skill and quick thought that he was able to save himself and his machine. Some idea may be had of his predicament when it is stated that it required a number of workmen and a motor truck several days to extricate the machine from the swamp.

Peculiar as it may seem, but few have given this singular instance much thought—merely accepting it as an aviator's misfortune. Carlstrom's experience was singular in that it happened at the very end of such a noteworthy achievement, but the misjudging of landing places has been the direct cause of many serious accidents which date back to the time when the airplane was first able to leave its home field. Had Carlstrom been equipped with an aëronautical chart of the proper kind, an incident which might have easily proved a serious accident could have been averted. His equipment lacked such a chart for the very good reason that none existed. Clippings from atlas and other small-scale maps showing only towns, railroads, and rivers went to make up the chart that was used for his flight.

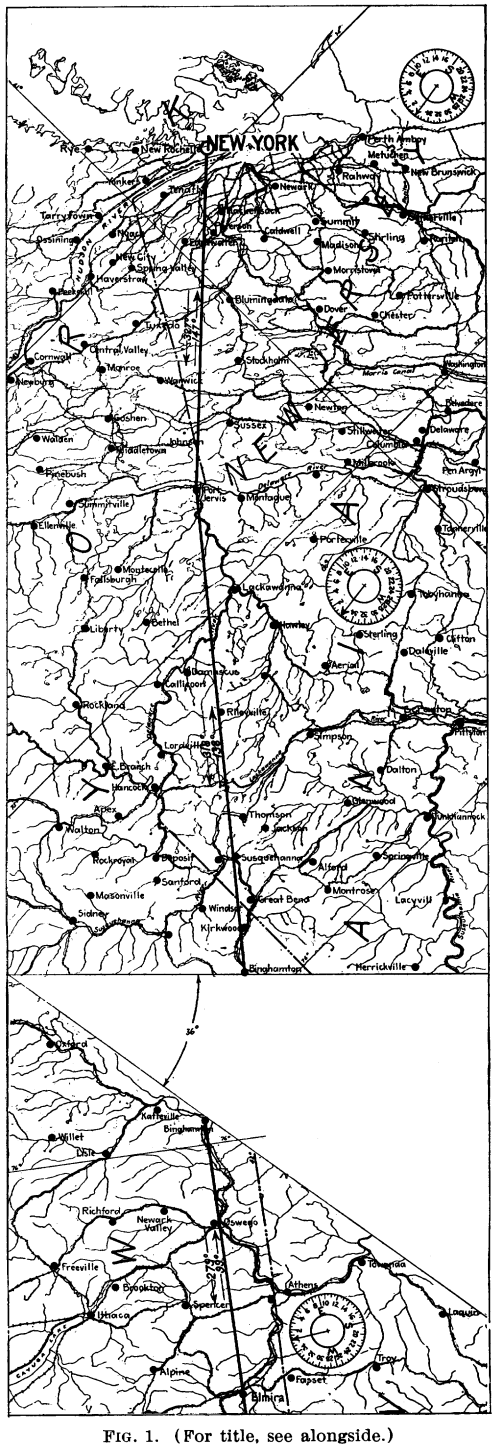

FIG. 1. (For title, see alongside.)

The development of the airplane has been so rapid and so much attention has been centered upon the machine itself that other things which go to help make the airplane a success have suffered neglect. The aëronautical chart is one of these.

The first aëronautical charts used in this country were probably composed of clippings from atlas and other maps, owing to the want of better material. One of the most complete charts of this sort up to that time was doubtless the one prepared for Lawrence Sperry's flight from Amityville, L. I., to Boston in the summer of 1916. As most of his flight was to be made over water, several large-scale standard marine charts covering the route were obtained and the course layed out on them. A strip ten inches wide, five inches either side of the course, was cut from each chart, and in order to facilitate their use the strips were mounted on linen and arranged to run over a pair of rollers.

Numerous requests for information concerning compass

TITLE OF FIG. 1—Reduced facsimile of a section of an aëronautical chart prepared by the Sperry Gyroscope Company, the original being on the scale of 8 miles to the inch. North is at the lower left.

The beginning of the New York-Chicago route is indicated by the heavy black line, each leg of the course being marked by its azimuth, for both going and coming. Wedge-shaped pieces similar to the one shown here are introduced in order to straighten out the turns made by the course and in order to produce a rectilinear map which can be passed over rollers (see Fig. 2.)

errors, the exact course to be steered between stated cities, etc., having been received by the Sperry Gyroscope Company because of their wide experience in aërial navigation, the company decided to meet the rapidly increasing demand by undertaking the preparation of aëronautical charts. A chart of Long Island was the first to be compiled. Shortly afterward a strip of territory from Fort Wadsworth, N. Y., to Princeton, N. J., was charted. This chart, combined with that of Long Island, was used by the group of airmen that flew to Princeton for the football game between Princeton and Yale in November, 1916. The Sperry aëronautical charts are made from

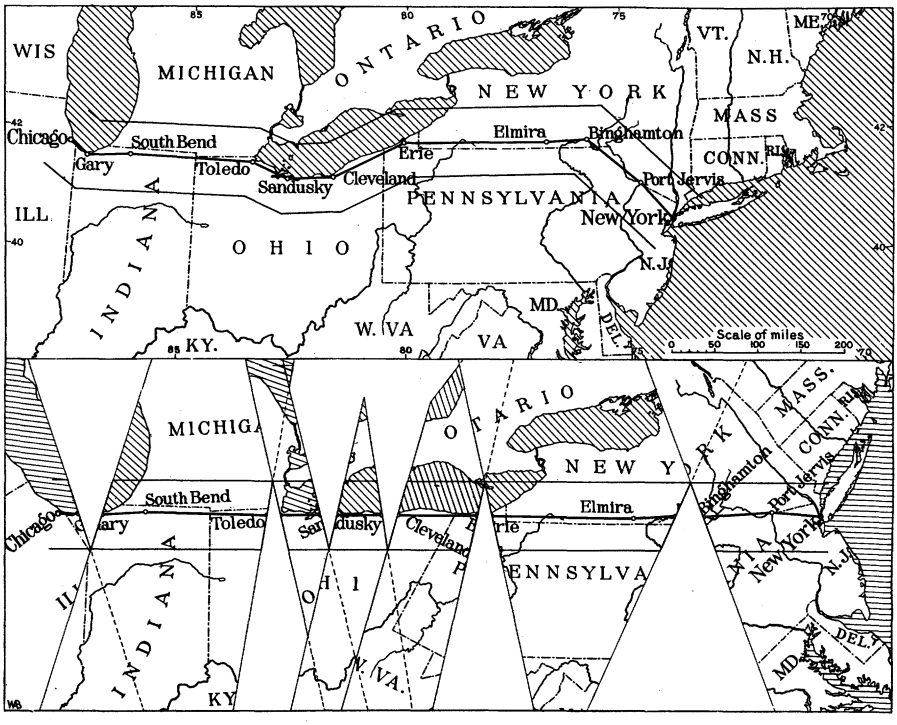

FIG. 2—Outline maps illustrating the method of producing rectilinear aëronautical charts by straightening out the course.

The upper half shows the route between New York and Chicago laid out on a regular map, with the bounding lines indicated of the territory to be included. The lower half shows this map cut apart, as it were, at the turning points in the course and straightened out. In drafting the final map the areas outside the bounding lines are excluded. Figure 1 shows the eastern end of the strip in detail.

maps compiled by the U. S. Geological Survey and are on a scale of from 2⅔ to 8 miles to the inch. Figure 1 shows the last lap of a Chicago-New York chart. The distinctive feature of these charts is that, regardless of the number of turns made in any particular flight, the whole chart is presented in a straight strip only ten inches wide. The advantage of such a method is that almost any scale may be used without making the chart cumbersome, since it lends itself readily to a pair of chart rollers, which can be mounted in a case and attached to the instrument cowl, if so desired.

The method used to prepare one of these charts may be more clearly shown by a few simple illustrations. The upper half of Figure 2 represents an airplane route between New York and Chicago as laid out on a map and bounded on either side by lines parallel to it and enclosing the strip of country to be charted. The remainder can now be cut away, thus eliminating a large amount of useless map. The straightening out of the course is attained by cutting the chart transversely at each turning point and arranging the separate sections as shown in the lower half of Figure 2. It will be noted from Figure 1 that in the vacant triangular space at the turning points the angular value of the change in the chart is designated. This will also be the change in course to be made at each point, providing the approach and departure are to be made along a course parallel to the sides of the chart, which is not always the case, however. It is better, therefore, to mark each leg of the course with its proper azimuth, as is done on Figure 1. This will also save the pilot the trouble, possibly at a critical time, of first considering whether the change should be added to or subtracted from the reading of his present course and then making the necessary calculation to obtain his new course.

As to content, the charts in question show the location of cities, railroads, and rivers. Up to the present time only one set of these charts has been made in colors, this being the one of Long Island. All of the remainder are in black and white.

Turning now from a discussion of what has been done in this field by one organization, it may be well to consider in general what remains to be done to develop fully this important adjunct of flying.

The requirements made of land charts naturally divide them into two general types: one for cross-country flights and the other for local flights.

Every aëronautical chart should portray all, or as many as possible, of the outstanding and essential features of the territory it covers. Among those of most value to the pilot are cities, towns, roads, railroads, rivers, landing places, altitudes, fuel and oil supply depots, and especially places that appear from above to be good landing places but are in reality swamps or other treacherous ground. The marking of a city or town should show some of its special characteristics, in order to aid the pilot in distinguishing it from other nearby towns of similar size. Probably the day is not far away when every city, town, and hamlet will have its name displayed in such a way that it will be legible from a great altitude. Such a plan would, however, be a disadvantage from a military point of view, as it would readily impart important knowledge to an enemy airman. Towns having facilities for making repairs to the plane should be so designated. Roads and railroads are clearly seen from above and are much used as landmarks. Rivers are also important landmarks and should be clearly designated.

Landing places should be divided into two groups, possible and good

landing places. The advantage of this division is that it gives the airman some choice in his landing place if the need of landing is not immediate. The position of telephone and telegraph wires and other dangerous obstructions should be indicated on all marked landing places. The experience of Victor Carlstrom, as related above, is sufficient proof of the need of marking dangerous territory that might deceive a pilot into believing it a good landing place.

In addition to these elements, all charts should carry a number of compass roses to indicate the meridian and the magnetic declination at various places along the course. A good way to help indicate the course would be to place compass roses at the beginning of each new course and every six or seven inches thereafter, the center of these roses to be on the course line and the north pointing to the magnetic north. The pilot would then have continually before him a graphic representation of the relation of his compass lubber-line to the card. In such a case the course to be steered would be indicated on the rose at the point where the course line passes through it and on the side toward which one may be traveling from the center—this on the assumption that the compass deviation error is negligible.

Charts for local use may be made on a large scale and marked similarly to those just described. A more convenient shape for these charts would be in the form of a rectangle or square with the flying field near the center.

All land charts should be colored in a manner to bring out the landmarks in their relative importance to the airman. The use of a standard code of symbols for indicating many of the country's features will prevent overcrowding and confusion.

The marine aëronautical chart has a very good beginning in the existing standard marine charts. These can be used to good advantage as they now stand, but a few slight modifications may render them even more suitable to the aviator's needs. The soundings need not be recorded, as they are of little or no value to the airman, but it would be well to indicate all of the distinctive features of the country for two or three miles inland. This would act as a great aid to an aviator who may have lost his way and perhaps save him the inconvenience and risk of landing in unfamiliar waters to inquire his whereabouts. Upon first thought it may be inferred that only poor navigation or incorrect course calculation could cause one to become so completely lost, but the wind has succeeded in playing many practical jokes on experienced aviators by carrying them considerably off their course. This is even more likely to be the case on marine than on land trips, owing to the absence of markings at sea.

Fortunately, a considerable amount, if not all, of the material required for aëronautical charts is at present available in the form of government and other maps, but much experience and time will be required to put it into useful form.